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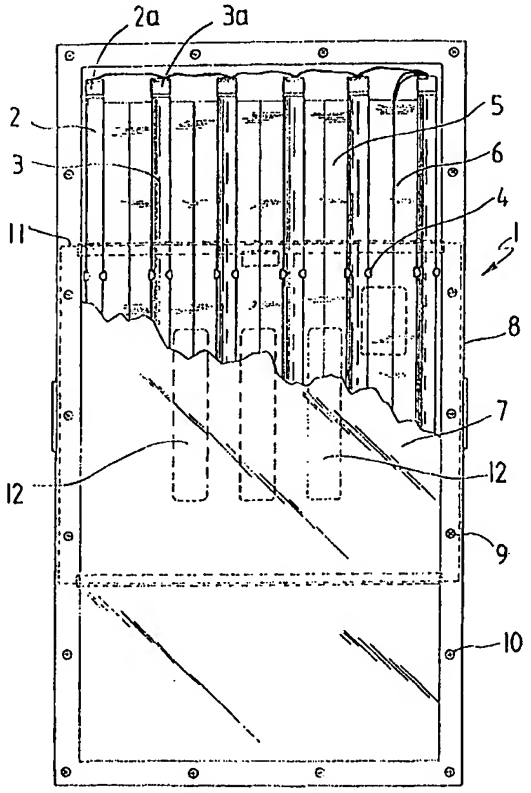
(54) Title: FLUORESCENT TUBE THEATRE LIGHT

(57) Abstract

A fluorescent tube operating light which is comprised of one or more sealable light modules with a transparent or translucent cover (7), each light module having a plurality of fluorescent tubes (2, 3) and reflectors (5, 6) in association with a tray (11) insertable into the light module for the location of electronic components (12) for the operation of the fluorescent tubes which is distal to the ends of the fluorescent tubes to minimise electrical interference and to keep the components cool. The means (4) for locating the fluorescent tubes also incorporates means (4) for holding the reflectors whereby there is provided an air gap between a reflector and an adjoining fluorescent tube for heat dissipation. The invention also has timing means to progressively record a total operating time of the fluorescent tubes and a mounting means for suspending the light modules to a fixture member wherein the light may be positioned to provide a desired field of illumination.



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FLUORESCENT TUBE THEATRE LIGHT

FIELD OF INVENTION

THIS INVENTION relates to a fluorescent tube light for use in particular with but not limited to operating theatres, medical and veterinary surgeries and other diagnostic applications.

BACKGROUND ART

Operating theatre lights suffer from a number of disadvantages as the light sources produce heat and tend to cast shadows. Such light sources are usually large structures suspended over an operating table and comprise a dished-shaped structure housing a cluster of individual spot lights which may be focused to converge on a small area to provide a relatively shadowless field of concentrated light but nevertheless provide a spotlight effect.

The disadvantage of having a cluster of very bright spot lights is that a significant amount of heat is generated especially where the light is concentrated. This makes operating conditions uncomfortable especially where surgical gowns and hoods are worn. In addition, adjustment of the surgeons eyes to rapid changes from a small brightly lit area to surrounding darker areas in the case of a spotlight can cause discomfort and compromise safety in operations as it is usual that full and unimpaired vision is required.

As a result of safety requirements and having to comply with hospital hygiene regulations, operating theatre lamps are expensive and maintenance costs also tend to be high. This can result in significant down time and disruption to surgical routines.

Servicing requires experienced staff, and again this adds to the overall budget costs. Due to their expensive nature and cost of servicing, routine and preventative replacement of older but still functioning lamp units is rarely a commercially viable option for the majority of hospitals unless the institution concerned has a significant budget allocated for this purpose.

OBJECT OF INVENTION

It is therefore an object of the present invention to alleviate at least to some degree the abovementioned problems associated with prior art operating theatre, medical and veterinary surgical and other diagnostic light sources. The

applicant has set out to improve operating theatre lights and in doing so has devised a number of independent inventions, each of these inventions can be used independently or in synergistic combination and have been described below both independently and in combination, the applicant reserves its rights to divide the application or claim the invention in combination subject to the results of an International Search.

In one invention there is provided an operating theatre light assembly the improvement comprising a plurality of light modules, the modules being adapted to flood an operating theatre with light well beyond the immediate operating area.

In another invention, there is provided an operating theatre light assembly comprising six fluorescent tubes and reflectors, above an operating surface, the range of light intensities being exemplified in the following table. The table shows light intensities measured from a datum point in the centre of the lens of a module by a light meter held at given distances from the datum.

The six fluorescent tubes providing a lower range intensities being Philips "TL" D/95 De Luxe fluorescent lamps 35W.

The six fluorescent tubes providing the upper range intensities being NEC Triphophor HG D 6700 Kelvin 37W.

Intensity in Lumens

Six tubes & reflectors		Distance from datum (mm)
NEC	PHILIPS	
294500	58900	300
147250	29450	600
73625	14275	900
36812.5	71375	1200
13406	3668.5	1500
6740	6703	1800

This table has been calculated based on measurements at the 300mm datum and a reasonable approximation for the assembly being taken at half the figure at 300mm intensities as an estimation for illustrative purposes only.

In another invention there is provided a operating theatre light assembly, the improvement comprising a cluster of light modules, each module having

about six fluorescent light and associated reflectors, the lights being supplied with power via an electric ballast to limit heat output and there being air flow passage means within the module to aid in dissipation of heat within the module. Preferably at least one of the light modules is rotatably mounted on a supporting frame.

In another invention there is provided a theatre light assembly comprising a plurality of modules arranged in a cluster and there being provided remote control dimming means enabling control of the lights other than by hand.

In another invention there is provided a theatre light module comprising a closed housing having an open-topped box and a light transparent cover to close the box, a tray insertable into the box before the cover is applied by clip action, the tray extending along and across a major portion of the box, the tray holding on one side thereof a ballast for lights spaced from the box and on the other side thereof a plurality of light support brackets and reflectors interposed between the light support brackets.

Preferably the box includes a rim having a flange forming a surround for the box, a securing ring, the transparent cover being sandwiched between the flange and the securing ring when the light module is assembled.

In one preferred aspect the present invention resides in a fluorescent tube operating theatre light comprising:-

a sealable enclosure for the housing of one or more fluorescent light tubes;

electronic components for the electrical operation of said fluorescent light tubes;

said components located on one or more platforms located above and distal to anodic and cathodic ends of the fluorescent light tubes;

one or more reflective surfaces in association with said fluorescent tubes whereby there is provided an air gap between a reflective surface and an adjoining fluorescent light tube;

timing means to progressively record a total operating time of said fluorescent light tubes;

said enclosure having one or more transparent or translucent covers for the diffusion of light from said fluorescent light tubes; and

mounting means for suspending said enclosure to a fixture member, wherein in use, said lamp may be pivoted and locked into position by said mounting means.

In another preferred aspect the invention resides in a fluorescent tube operating theatre lamp comprising a plurality of sealed enclosures pivotally attached to a supporting frame;

said enclosures each having one or more fluorescent light tubes;

electronic components for the electrical operation of said fluorescent light tubes;

said electronic components located on one or more platforms located above and distal to anodic and cathodic ends of the fluorescent light tubes;

one or more reflective surfaces in association with said fluorescent tubes whereby there is provided an air gap between a reflective surface and an adjoining fluorescent light tube;

one or more timing means to progressively record a total operating time of said fluorescent light tubes;

said enclosures having one or more transparent or translucent covers for the diffusion of light from said fluorescent light tubes; and

mounting means for suspending of the said enclosures to the said framework, wherein in use, said enclosures may be individually pivoted and locked into position by said mounting means.

In preference the sealable enclosure is of a pressed steel configuration however it may be made of other materials such as plastic, Kevlar™ or fibreglass. The enclosure is preferably rectangular in shape if housing elongated fluorescent light tubes however may be suitably circular if round type fluorescent light tubes are used.

Preferably the electronic components selected for the operation of the fluorescent light tubes will be of a design which produce as little heat as possible.

Suitably the one or more platforms from which the electronic components are located is positioned above the fluorescent light tubes and at some distance from the anodic and cathodic ends of the light tubes to minimise electrical interference as well as to maximise cooling of the electrical components. In one

form of the invention the platforms may be associated with a rigid bar removably attachable to the free edges of the platform to prevent the platform from bending thereby maintaining an adequate distance above the florescent tubes to minimise heat and electrical interference and thereby locking the platform in position with respect to the enclosure.

Preferably the reflective surfaces are mirror finished steel or aluminium and have a suitable configuration to maximise light reflection from the fluorescent light tubes. Preferably the means for locating the fluorescent tubes also incorporate means for holding the reflective surfaces whereby there is provided a gap for the passage of air between a reflective surface and an adjoining fluorescent light tube for the dissipation of heat.

Preferably the timing means to progressively record the operative time of the fluorescent light tubes has a digital display panel and the timing device may have an independent power source such that general power failure will not erase stored data.

Suitably the one or more transparent or translucent covers may be clear or opalescent acrylic or safety glass depending on the application and the intensity of illumination required. Suitably the translucent or transparent covers are secured to the enclosure by sandwiching a cover between the securing ring and the flange of an enclosure and preferably a silicone based sealer in combination with screws or nuts and bolts fasteners may be used to secure the assembly.

In one form of the invention, there may be blind ended screws threaded into the securing ring in order to break the seal between the cover and the securing ring by a lifting action for the replacement or cleaning of the covers.

Suitably the mounting means for suspending the enclosure includes a bracket attached to a carry strap. The bracket having one or more arcuate slots associated with a wing nut or turn screw locking mechanism such that the bracket may be pivoted about a cental axis and locked into position by the wing nut or turn screw means along any portion of the one or more arcuate slots. Preferably the fixture member is a central support member extending downwards from a roof of an operating theatre or suitably said fixture member may be attached to an

upright floor standing pedestal having a offset hinged boom member connected to the mounting means. The offset hinge being of a configuration that maximum closing of the hinge still allows for a space between hinged members such that accidental pinching or crushing of fingers is avoided.

In preference the supporting frame for an operating theatre lamp comprising a plurality of pivotally attached separate modules is a rectangular frame attached to a ceiling of an operating theatre having downward extending arms attached to brackets with arcuate slots as hereinabove described whereby the modules may be adjustably pivoted to provide a desired field of light. Alternatively, the separate modules may be hinged together along adjacent free edges and may be locked in position with respect of each other by means of bracket with arcuate slots associated with wing nut or turn screw locking mechanisms.

BRIEF DESCRIPTION OF THE DRAWINGS

In order that the present invention may be more readily understood and be put into practical effect reference will now be made to the accompanying drawings whereon:-

Figure 1 is a plan view of an light according to the invention;

Figure 2 shows detail of the means of locating fluorescent tubes and reflectors of the invention;

Figure 3 shows a detail of the method of locating the covers according to the invention;

Figure 4 shows a cross section through an assembly showing detail of the acrylic cover sandwiched between the flange and securing ring according to the invention;

Figure 5 shows detail of the gear tray according to the invention;

Figure 6 shows a cross section of the enclosure and mounting means according to the invention;

Figure 7 shows further detail of the means of fixing and removal of the acrylic cover;

Figure 8 shows a ceiling suspended theatre light according to the invention;

Figure 9 shows a light mounted on a parallel track according to the invention;

Figure 10 shows a boom mounted operating light according to the invention;

Figure 11 shows an operating theatre light assembly having a plurality of individual light modules according to the invention;

Figure 12 shows a plan view of a operating theatre light of Figure 11; and

Figures 13a, 13b and 13c show a cross section through an assembly of detail of a seal breaking mechanism according to the invention.

DETAILED DESCRIPTION OF THE DRAWINGS

Referring now to drawings and initially to Figure 1 there is shown a plan view of an enclosure 1 housing fluorescent light tubes 2, 3. The fluorescent light tubes 2, 3 are held in place by means of circular clips 4 which also support prism

shaped reflectors 5, 6 of mirror polished steel. The clear acrylic cover 7 is sandwiched between a securing ring 8 and the flange of the housing (not shown) by means of phillips head screws 9, 10. A gear tray 11 (shown in phantom) on which are mounted electronic ballasts 12 (also shown in phantom) is located in the central portion of the enclosure 1 and at a distance from the discharge ends 2a, 3a of the fluorescent tubes 2, 3.

Figure 2 shows detail of the means of locating the fluorescent tubes 13, 14, 15 which also provide a means of holding the reflectors 16, 17 by means of circular clips 18, 19, 20 such that there is an air gap 21 for the dissipation of heat 22 between the reflectors 16, 17 and an adjacent fluorescent tube, 14.

Figure 3 shows detail of the flange 23 of an enclosure incorporating a nut 24 welded to the flange 23 for the purposes of sandwiching the acrylic cover 25 between the flange 23 and the securing ring 26. The holes 27, 28 in the acrylic cover 25 and securing ring 26, respectfully allow the passage of a machine screw or bolt (not shown) to be threaded into the nut 24.

Figure 4 shows a cross section through an assembled enclosure showing detail of the acrylic cover 25 sandwiched between the flange 31 of the enclosure and the securing ring 26 by means of a machine screw 29 and nut 30. In this embodiment, the nut 30 is not welded to the flange 31.

Figure 5 shows a gear tray 32 on which are located the electronic components 33 for the operation of the fluorescent tubes (not shown). The gear tray 32 is of a flexible sheet metal design which is fitted to the inside an enclosure 34 and located by the flanges 35 of the enclosure. The gear tray 32 may be locked in position by a rigid bar 36 of U-shaped cross section which is clipped along a free edge 37 of the gear tray. The bar 36 also prevents the gear tray 32 from flexing thereby maintaining an adequate distance above the fluorescent tubes (not shown) minimising any electrical interference and effect by heat. In this embodiment there are also recessed plug sockets 38, 39 at the surface of the enclosure which enables the electronic components to be sealed within the enclosure and supplied with electricity externally through a complementary fitting plug (not shown).

Figure 6 shows a cross sectional elevation showing the enclosure 40

supported by a carry strap 41 to which is attached by a bolt 41a to a bracket 42 having an arcuate slot 43. The bracket 42 is centrally pivoted about an axial bolt 44 and lockable by a turn screw 45. The electronic ballasts 46 and plug sockets 47 are shown on the gear tray 48 which in this embodiment also provides support for the circular clips 49 holding the fluorescent tubes 50 and reflectors 51. The acrylic cover 52 is shown sandwiched between the flange 53 of the enclosure 40 and the securing ring 54.

Figure 7 shows detail of the acrylic cover 52 sandwiched between the flange 53 and the securing ring 54. Machine screw 55, threaded into a nut 53a welded to the flange, 53 are shown in this embodiment however other fastening means may by used for example phillips head screws or pop rivets. There is shown a blind ended screw 56 threaded into the securing ring 54 for the breaking of the seal between the acrylic cover 52 and the securing ring 54. To distribute the force of the blind ended screw 56, a disc of steel 57 is used to distribute the force of the blind ended screw 56 in lifting the acrylic cover 52.

Figure 8 shows the theatre light 58 suspended from a ceiling mounted boom 59 operated by means of a hydraulic ram 60. The position of the light 58 may be further varied by means of the bracket with an arcuate slot 61 and the extension of the ram 60.

Figure 9 shows a light 62 mounted on a parallel track 63 for use in a workshop environment.

Figure 10 shows a boom mounted operating theatre light 64 attached by means of a hinge 65 to a pedestal 66 having a remote control 67 with a foot operated switch 68 to operate a electric servo 69 used to elevate the boom 70. The position of the light 64 may be further varied by means of the bracket with an arcuate slot 71 and the light 64 may be further rotated in the direction of the arrows 72.

Figure 11 shows the version of the operating theatre light 73 having a plurality of individual light modules 74, 75 suspended from a supporting framework 76 mounted to the ceiling 77. In this embodiment the central light 78 provides a mounting for the other light modules 74, 75 which are pivoted by means of hinges 74a, 75a between the free edges of the light modules 74, 75

and the central light, 78.

Figure 12 is a plan view of the operating theatre light 73 of Figure 11 from above showing the electrical connections 79 to light modules 74, 75. The light modules 74, 75 are shown hinged together along their free edges by means of piano type hinges 74a, 75a. The central light 78 is fixed and the hinged light modules 74, 75 are positioned relative to the central light 78 by means of friction operated stays 80.

Figure 13a shows detail of an assembly in which the acrylic cover 81 is sandwiched between a securing ring 82 and a channel-shaped member 83 which is bonded to a fibreglass (or Kevlar™) enclosure 84. The acrylic cover 81 is sandwiched between the channel-shaped member 83 which is bonded to the fibreglass enclosure 84 and the securing ring 82 by means of a machine screw 85 tightened against a nut 86 glued for installation purposes to the channel-shaped member 83. There is a short machine screw 87 threaded into the securing ring 82 which further secures the enclosure 84 to the securing ring 82.

Figure 13b shows the removal of machine screws 85 and 87 of Figure 13a. The removal of machine screw 85 of Figure 13a results in the displacement of the nut 86 to the interior of the module.

Figure 13c shows the mechanism used to break the seal between the acrylic cover 81, the securing ring 82 and the channel-shaped member 83 which comprises the use of a jig 88. The jig 88 has a machine screw 89 which fixes the securing ring 82 and a machine bolt 90 which passes through the hole 91 in the securing ring 82 and a hole 92 in the channel-shaped member 83 originally used for the passage of the machine screw 85 shown in Figure 13a. The machine bolt 90 is screwed into the jig 88 and applies pressure against the upper arm 83a of the channel-shaped member 83 which results in breaking the seal between the lower arm 83b of the channel-shaped member 83, the acrylic cover 81 and the securing ring 82.

The attached appendix is a photometry report for a preferred operating theatre light according to the present invention.

Whilst the above has been given by way of illustrative example of the present invention many variations and modifications thereto will be apparent to those skilled in the art without departing from the broad ambit and scope of the

invention as herein set forth in the appended claims.

PHOTOMETRIC LABORATORY

TEST REPORT

REPORT NO: MEDI9601

CLIENT: MEDIPORT PTY LTD

NATURE OF TEST: Photometry of a Luminaire

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Queensland University of Technology

PHOTOMETRIC LABORATORY

TEST REPORT

REPORT NO : MEDI9601

CLIENT : MEDIPORT Pty Ltd

NATURE OF TEST : Distribution Photometry of a Luminaire

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PHOTOMETRIC LABORATORY

TEST REPORT

REPORT NO : MEDI9601 Job No : 210

DATE OF ISSUE : 12th August 1996

CLIENT : MEDIPORT Pty Ltd

2 Riding Road.
Hawthorne Qld 4171

NATURE OF TEST : Distribution Photometry of a Luminaire

LUMINAIRE :

Mediport Light Box
6 x 1.2m fluorescent tubes with individual reflectors
aperture 1.3 x 0.6 m with single diffusing acrylic cover
Catalog No : none given

LAMPS :

Philips 'TL'D/95 De Luxe fluorescent lamps 35W (6 of)

BALLAST :

Philips ETC 138 R/04 38W

TESTS PERFORMED :

Luminous intensity readings (absolute) in the C,γ planes at the following intervals.
C plane : 0° - 360° in steps of 30°
γ plane : 0° - 100° in steps of 5°

Testing Supervisor _____ Date 12/8/96
Dr Ian Cowling

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PHOTOMETRIC LABORATORY
TEST REPORT

Report No : MEDI9601 LUMINAIRE : Mediport Lightbox

LAMP : Philips 'TL'D/95 De Luxe fluorescent lamps 35W (6 of)
BALLAST : Philips ETC 138 R/04 38W

NOTES ON MEASUREMENTS PERFORMED :

Lamp Aging : The lamps, mounted in the luminaire, were aged in the laboratory for about 110 hours prior to commencement of testing.

Mounting : The photometric centre of the luminaire was taken as the geometrical centre of the diffusing front surface of the luminaire.

Test Distance : 9.251 ± 0.006 m

Test Temperature : 25° ± 1°

Notes regarding Lamp and Ballast Selection :

The intensity values expressed in this report are quoted in candela per 1000 lamp lumens. For calculations using this data the appropriate ballast factor and manufacturer's rated lumens of the chosen luminaire components must be taken into account. Note that the use of other lamp / ballast combinations than those used for this test report may give different results.

Uncertainties : (values given for a 95% confidence level)

cd / 1000 lamp lumens :	±3%
light output ratio :	±4.2%
angular displacement :	±0.5°

Test Procedure :

The tests have been carried out in accordance with the relevant sections of Australian Standard AS1680.3 (1991).

Testing Supervisor _____ Date 12/2/96
Dr Ian Cowling

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PHOTOMETRIC LABORATORY

TEST REPORT

Report No : MEDI9601 LUMINAIRE : Mediport Lightbox

LAMP : Philips 'TL'D/95 De Luxe fluorescent lamps 35W (6 of)
BALLAST : Philips ETC 138 R/04 38W

Luminous Intensity (cd / 1000 lamp lumens)

INTENSITIES IN CD/1000 LAMP LUMENS												
ANGLE OF ELEVATION (DEGREES)	AZIMUTH ANGLE (DEGREES)											
	0	30	60	90	120	150	180	210	240	270	300	330
0	326	326	326	326	326	326	326	326	326	326	326	326
5	319	326	335	336	329	321	322	328	336	336	327	319
10	302	312	323	326	318	307	308	315	326	326	315	303
15	275	286	301	307	297	283	284	292	307	308	294	278
20	245	256	271	269	264	253	252	263	278	276	266	248
25	218	228	239	236	232	225	225	235	245	240	234	221
30	194	205	213	211	206	201	202	211	217	214	206	198
35	173	182	190	192	184	179	180	188	194	194	183	174
40	151	160	170	173	165	158	159	166	174	175	164	153
45	130	139	150	154	146	138	138	144	154	157	144	132
50	110	119	131	136	128	118	117	123	135	138	126	113
55	91	99	112	117	110	99	97	103	116	119	108	94
60	73	81	93	97	91	81	78	84	96	100	89	76
65	57	69	74	78	74	64	62	67	78	80	72	60
70	42	51	56	58	55	47	46	49	59	60	54	44
75	29	34	38	39	38	32	31	34	40	42	37	30
80	16	19	21	22	21	18	18	19	23	24	22	17
85	6	7	8	8	8	7	7	8	9	10	8	7
90	1	1	1	1	1	1	1	1	1	1	1	1
95	0	0	1	1	1	1	0	0	1	1	1	1
100	1	1	1	1	1	1	1	1	1	1	1	1
105	0	0	0	0	0	0	0	0	0	0	0	0
110	0	0	0	0	0	0	0	0	0	0	0	0
115	0	0	0	0	0	0	0	0	0	0	0	0
120	0	0	0	0	0	0	0	0	0	0	0	0

USING 2 DEGREE ZONES		USING 10 DEG. ZONES	
LOR =	0.656	LOR	0.658
DLOR =	0.655	DLOR	0.657
ULOR =	0.001	ULOR	0.001

Testing Supervisor _____ Dr Ian Cowling

Date 12/9/96

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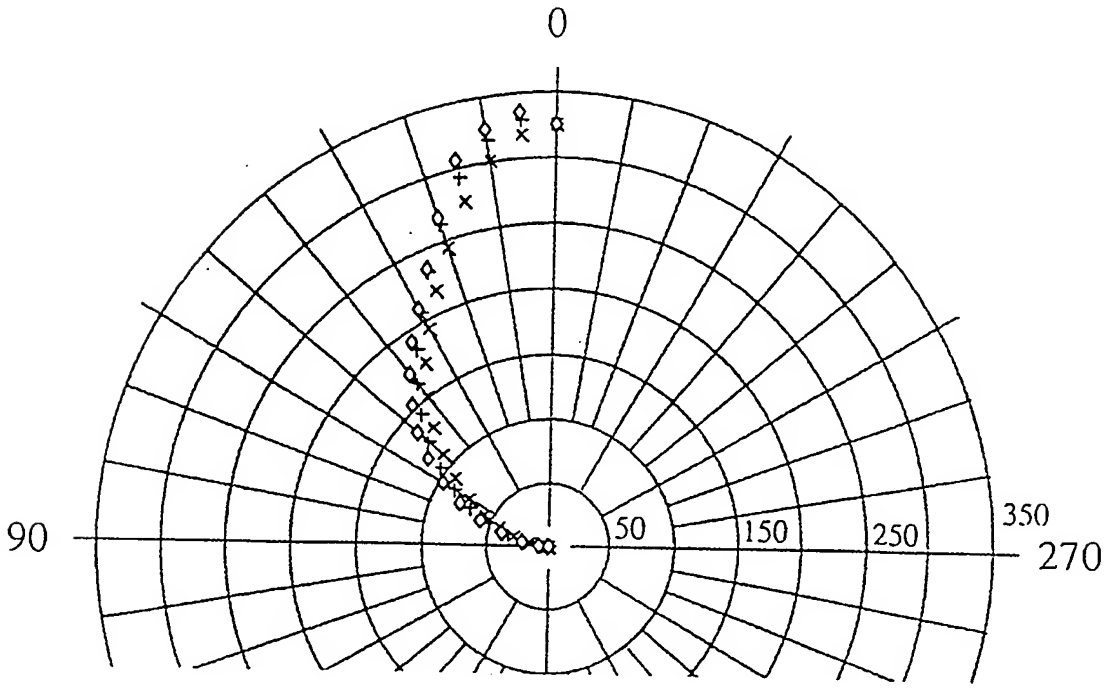
PHOTOMETRIC LABORATORY
TEST REPORT

Report No : MEDI9601 LUMINAIRE : Mediport Lightbox

LAMP : Philips 'TL'D/95 De Luxe fluorescent lamps 35W (6 of)
BALLAST : Philips ETC 138 R/04 38W

Polar Plot



Testing Supervisor _____ Dr Ian Cowling

Date 12/8/96

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PHOTOMETRIC LABORATORY

TEST REPORT

Report No : MEDI9601

LUMINAIRE : Mediport Lightbox

LAMP : Philips 'TL'D/95 De Luxe fluorescent lamps 35W (6 of)
BALLAST : Philips ETC 138 R/04 38W

Utilization Factors

Utilisation Factors UF(F) Standard Presentation SHR NOM 1.25

Room Reflectance			Room Index								
C	W	F	0.75	1.00	1.25	1.50	2.00	2.50	3.00	4.00	5.00
0.70	0.50	0.20	0.40	0.47	0.51	0.55	0.59	0.62	0.64	0.67	0.69
	0.30		0.36	0.42	0.47	0.50	0.55	0.59	0.61	0.64	0.67
	0.10		0.32	0.39	0.43	0.47	0.52	0.56	0.58	0.62	0.65
0.50	0.50	0.20	0.39	0.45	0.50	0.53	0.57	0.60	0.62	0.64	0.66
	0.30		0.35	0.41	0.46	0.49	0.54	0.57	0.59	0.62	0.64
	0.10		0.32	0.38	0.43	0.46	0.51	0.55	0.57	0.60	0.63
0.30	0.50	0.20	0.38	0.44	0.48	0.51	0.55	0.58	0.60	0.62	0.63
	0.30		0.35	0.41	0.45	0.48	0.52	0.55	0.57	0.60	0.62
	0.10		0.32	0.38	0.42	0.46	0.50	0.53	0.56	0.59	0.61
0.00	0.00	0.00	0.30	0.36	0.40	0.44	0.48	0.51	0.53	0.56	0.58

Testing Supervisor Dr Ian Cowling

Date 12/2/96

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PHOTOMETRIC LABORATORY

TEST REPORT

Report No : MEDI9601 LUMINAIRE : Mediport Lightbox

LAMP : Philips TL'D/95 De Luxe fluorescent lamps 35W (6 of)
BALLAST : Philips ETC 138 R/04 38W

Zonal Flux - 10° intervals

Angle to Downward Vertical (Degrees)	Luminous Flux (lm/1000 lm)
0 - 10	31
10 - 20	83
20 - 30	107
30 - 40	116
40 - 50	111
50 - 60	94
60 - 70	69
70 - 80	37
80 - 90	9
90 - 100	1
100 - 110	0
110 - 120	0

LIGHT OUTPUT RATIOS

Upward (ULOR)	:	0.001
Downward (DLOR)	:	0.66
Total (LOR)	:	0.66

Average Luminance of Luminaire

Angle to Downward Vertical (Degrees)	Average Luminance 0 deg. in Azimuth (Kcd/sq. m)	90 deg. in Azimuth (Kcd/sq. m)
85	5.21	6.71
75	7.93	10.84
65	9.67	13.15
55	11.30	14.55

Colour Measurements - Chromaticity coordinates of emitted light :

x	y	z
0.398	0.387	0.215

Requirements for white lamps : $x \geq 0.310$ and $x \leq 0.500$
$y \leq 0.150 + 0.640x$ and $y \leq 0.440$
$y \geq 0.050 + 0.750x$ and $y \geq 0.382$

Corresponding Colour Temperature : 3625 ± 50 K

Testing Supervisor _____ Date 12/8/96
Dr Ian Cowling

CLAIMS

1. A fluorescent tube operating theatre light comprising:-

a sealable enclosure for the housing of one or more fluorescent light tubes;

electronic components for the electrical operation of said fluorescent light tubes;

said components located on one or more platforms located above and distal to anodic and cathodic ends of the fluorescent tubes;

one or more reflective surfaces in association with said fluorescent tubes whereby there is provided an air gap between a reflective surface and an adjoining fluorescent light tube;

timing means to progressively record a total operating time of said fluorescent light tubes;

said enclosure having one or more transparent or translucent covers for the diffusion of light from said fluorescent light tubes; and

mounting means for suspending said enclosure to a fixture member, wherein in use, said lamp may be pivoted and locked into position by said mounting means.

2. A fluorescent tube operating theatre light as claimed in claim 1 wherein there is a plurality of sealed enclosures pivotally attached to a supporting frame.

3. A fluorescent tube operating theatre light as claimed in claim 1 or claim 2 wherein the sealable enclosures are of a pressed steel configuration.

4. A fluorescent tube operating theatre light as claimed in claim 1 or claim 2 wherein the sealable enclosures are made of plastic.

5. A fluorescent tube operating theatre light as claimed in claim 1 or claim 2 wherein the sealable enclosures are made of kevlar.

6. A fluorescent tube operating theatre light as claimed in claim 1 or claim 2 wherein the sealable enclosures are made of fibreglass.

7. A fluorescent tube operating theatre light as claimed in claim 1 or claim 2 wherein the enclosure is rectangular.

8. A fluorescent tube operating theatre light as claimed in claim 1 or claim 2 wherein the enclosure is circular.

9. A fluorescent tube operating theatre light as claimed in claim 1 or claim 2 wherein the fluorescent tubes are of a circular configuration.

10. A fluorescent tube operating theatre light as claimed in claim 1 or claim 2 wherein the platforms on which the electronic components are located are associated with a rigid bar removably attached to free edges of the platform to prevent the platform from bending.

11. A fluorescent tube operating theatre light as claimed in claim 10 wherein the rigid bar acts as a lock to lock the platform in position in the enclosure.

12. A fluorescent tube operating theatre light as claimed in claim 1 or claim 2 wherein the reflective surfaces are mirror finished steel to maximise light reflection from the fluorescent light tubes.

13. A fluorescent tube operating theatre light as claimed in claim 1 or claim 2 wherein the reflective surfaces are mirror finished aluminium.

14. A fluorescent tube operating theatre light as claimed in claim 1 or claim 2 wherein the means for locating the fluorescent tubes also incorporates means for holding the reflective surfaces whereby there is provided a gap for passage of air between a reflective surface and an adjoining fluorescent light tube for the dissipation of heat.

15. A fluorescent tube operating theatre light as claimed in claim 1 or claim 2 wherein the timing means to progressively record the operative time of the fluorescent light tubes has data storage means.

16. A fluorescent tube operating theatre light as claimed in claim 1 or claim 2 wherein the timing means has an independent power supply such that general power failure will not erase stored data.

17. A fluorescent tube operating theatre light as claimed in claim 1 or claim 2 wherein the timing means has a digital display panel.

18. A fluorescent tube operating theatre light as claimed in claim 1 or claim 2 wherein the covers are transparent.

19. A fluorescent tube operating theatre light as claimed in claim 1 or claim 2 wherein the covers are translucent.

20. A fluorescent tube operating theatre light as claimed in claim 1 or claim 2 wherein the covers are made of clear acrylic.

21. A fluorescent tube operating theatre light as claimed in claim 1 or claim 2 wherein covers are made of opalescent acrylic.

22. A fluorescent tube operating theatre light as claimed in claim 1 or claim

2 wherein the covers are made of safety glass.

23. A fluorescent tube operating theatre light as claimed in claim 1 or claim 2 wherein the covers are secured in the enclosure by sandwiching the covers between a securing ring and the flange of the enclosure.

24. A fluorescent tube operating theatre light as claimed in claim 23 wherein a silicone based sealer is used in combination with screws or nuts and bolts fasteners to secure the covers, the securing ring and the flange of the enclosure.

25. A fluorescent tube operating theatre light as claimed in claim 23 or claim 24 wherein there may be blind ended screws threaded into the securing ring in order to break the seal between cover and the securing ring by a lifting action for the replacement or cleaning of the covers.

26. A fluorescent tube operating theatre light as claimed in claim 1 or claim 2 wherein the mounting means for suspending the enclosure includes a bracket attached to a carry strap.

27. A fluorescent tube operating theatre light as claimed in claim 26 wherein the bracket has one or more arcuate slots associated with a wing nut or turn screw locking mechanisms such that the bracket may be pivoted about a central axis and locked into position by the wing nut or turn screw means along any portion of the one or more arcuate slots.

28. A fluorescent tube operating theatre light as claimed in claim 1 or claim 2 wherein the fixture member is a central support member extending downwards from a roof of an operating theatre.

29. A fluorescent tube operating theatre light as claimed in claim 1 or claim 2 wherein the fixture member may be attached to an upright floor standing pedestal having an offset hinged boom member connected to the mounting means.

30. A fluorescent tube operating theatre light as claimed in claim 29 wherein the offset hinge is of a configuration that maximum closing of the hinge allows for a space between hinged members such that accidental pinching or crushing of fingers is avoided.

31. A fluorescent tube operating theatre light as claimed in claim 2 wherein the supporting frame is a rectangular frame attached to a ceiling of an operating theatre having downward extending arms attached to brackets with arcuate slots

whereby the separate enclosures are adjustably pivoted to provide a desired field of light.

32. A fluorescent tube operating theatre light as claimed in claim 31 wherein the separate enclosures may be hinged together along adjacent free edges and may be locked into position with respect of each other by means of a bracket with arcuate slots associated with wing nuts or turn screw locking mechanisms.

33. A fluorescent tube operating theatre light as claimed in any one of the above claims wherein there is provided remote control dimming means enabling control of the lights other than by hand.

34. A fluorescent tube operating theatre light as claimed in any one of the above claims adapted to flood an operating theatre with light well beyond the immediate operating area.

35. A fluorescent tube operating theatre light as claimed in any one of the above claims wherein the light intensity is in the range of 294500 to 58900 lumens at a distance of 300mm.

36. A fluorescent tube operating theatre light as claimed in any one of the above claims wherein the light intensity is in the range of 147250 to 29450 lumens at a distance of 600mm.

37. A fluorescent tube operating theatre light as claimed in any one of the above claims wherein the light intensity is in the range of 73625 to 14275 lumens at a distance of 900mm.

38. A fluorescent tube operating theatre light as claimed in any one of the above claims wherein the light intensity is in the range of 36812.5 to 71375 lumens at a distance of 1200mm.

39. A fluorescent tube operating theatre light as claimed in any one of the above claims wherein the light intensity is in the range of 13406 to 3668.5 lumens at a distance of 1500mm.

40. A fluorescent tube operating theatre light as claimed in any one of the above claims wherein the light intensity is in the range of 6740 to 6703 lumens at a distance of 1800mm.

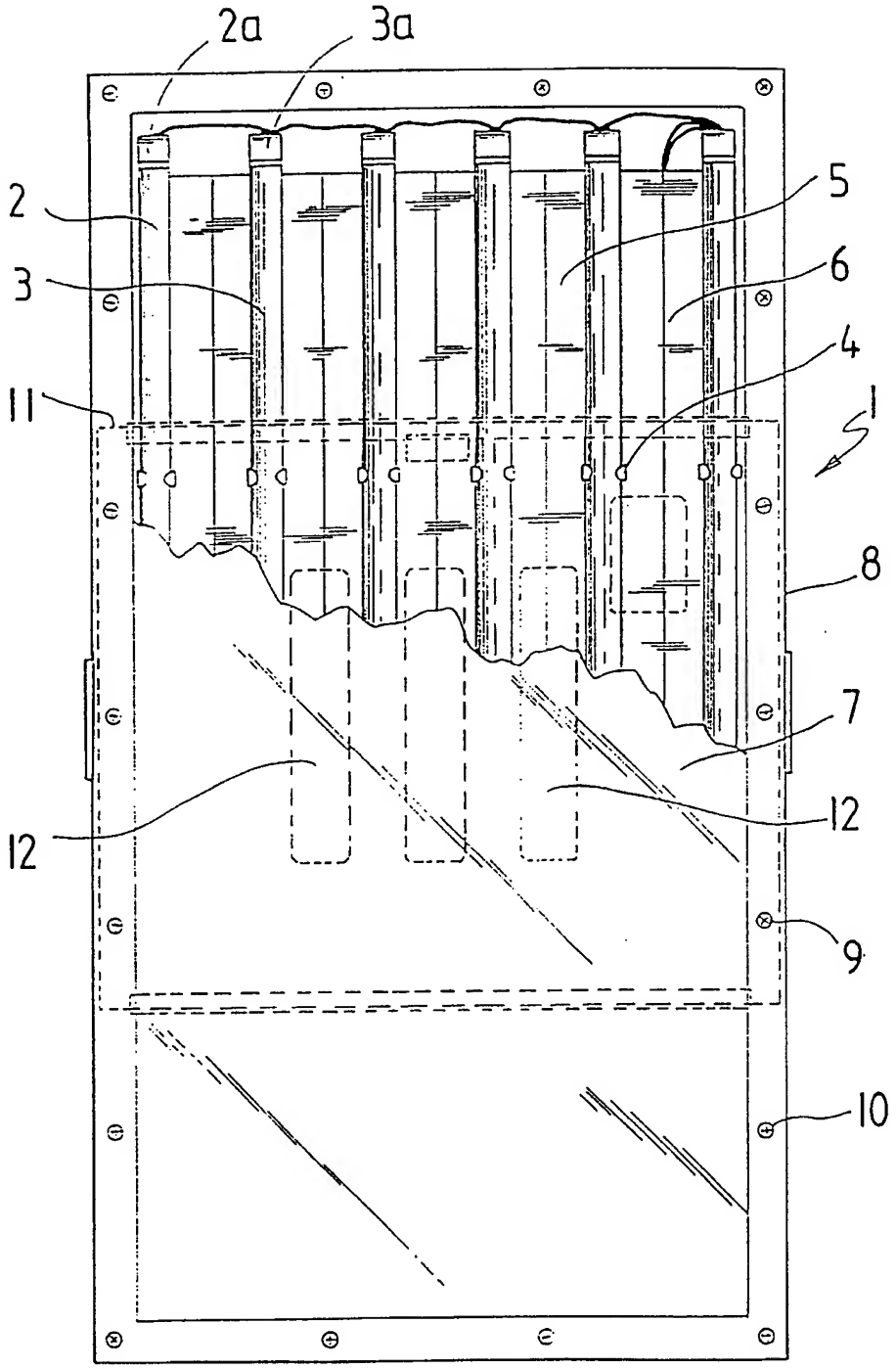


FIG 1

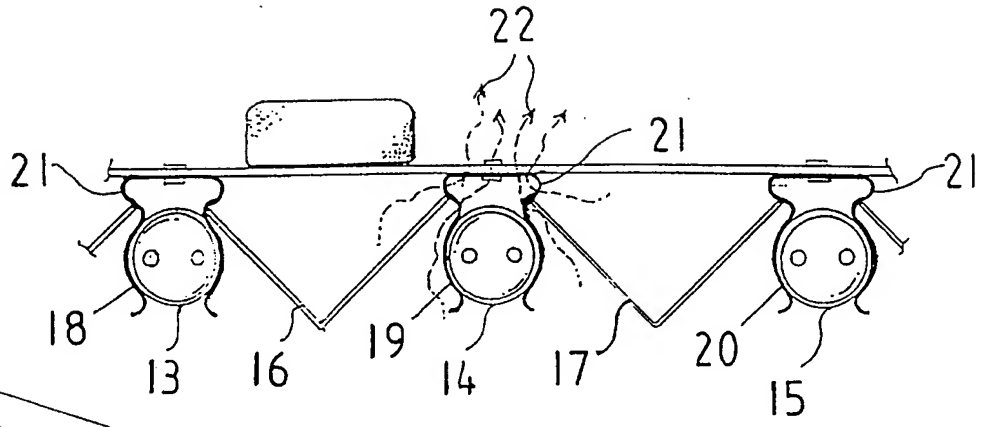


FIG 2

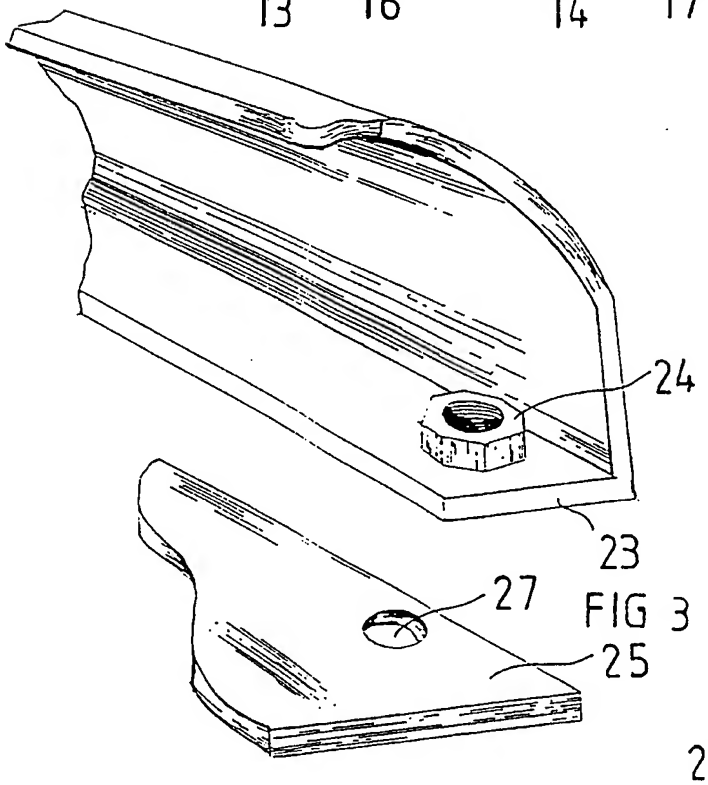
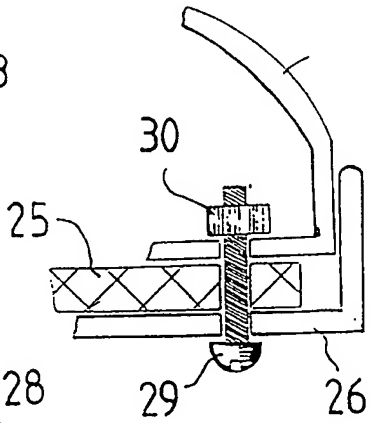


FIG 3



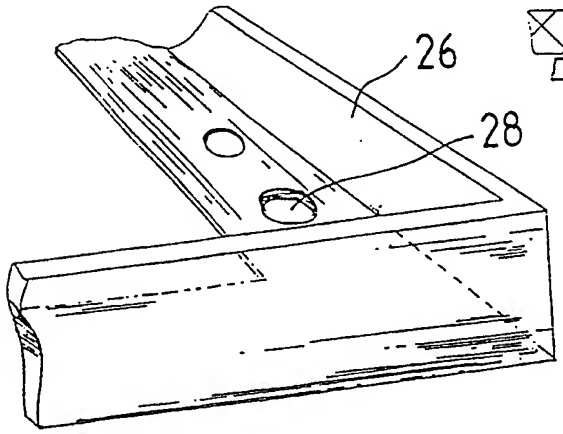


FIG 4

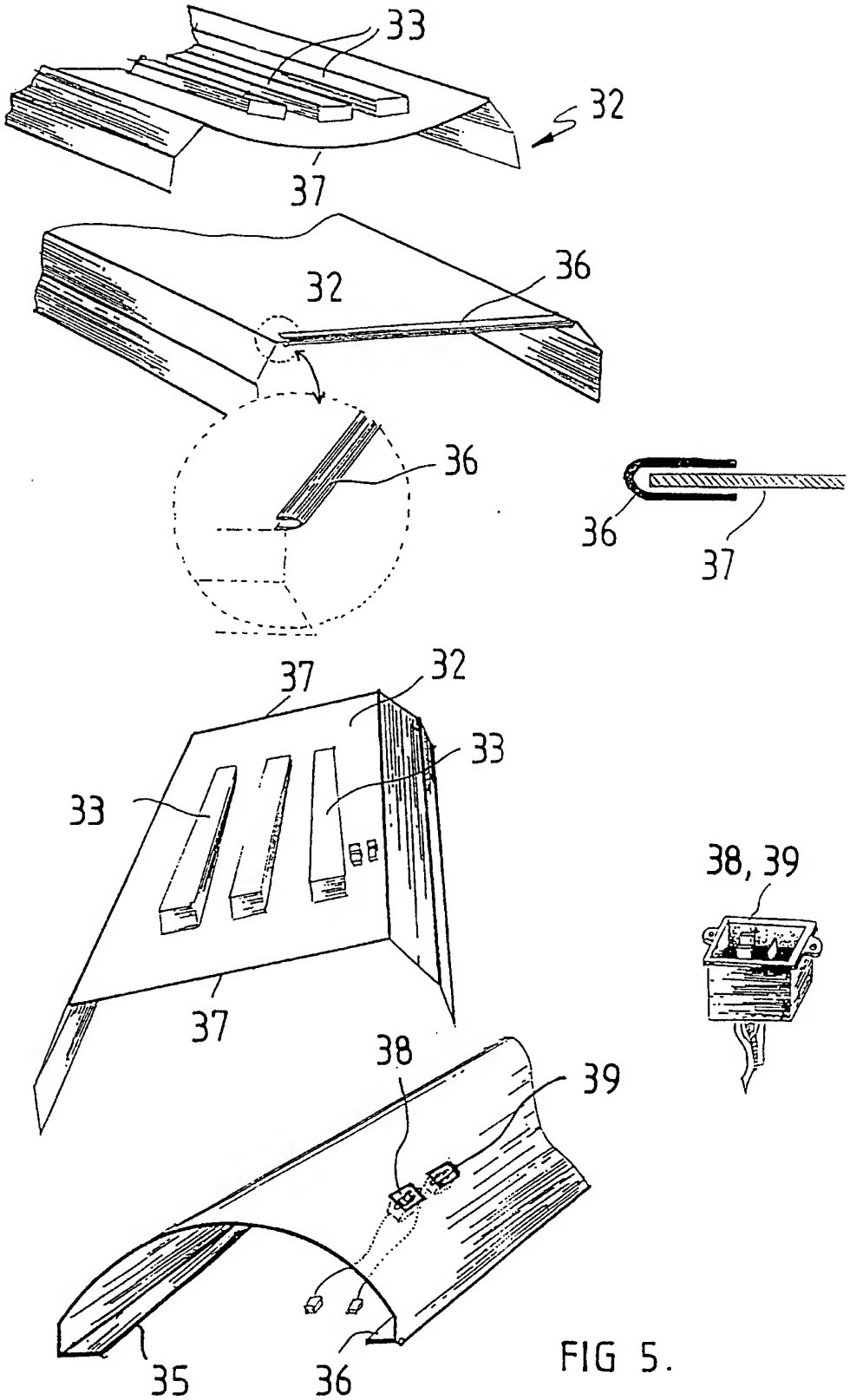


FIG 5.

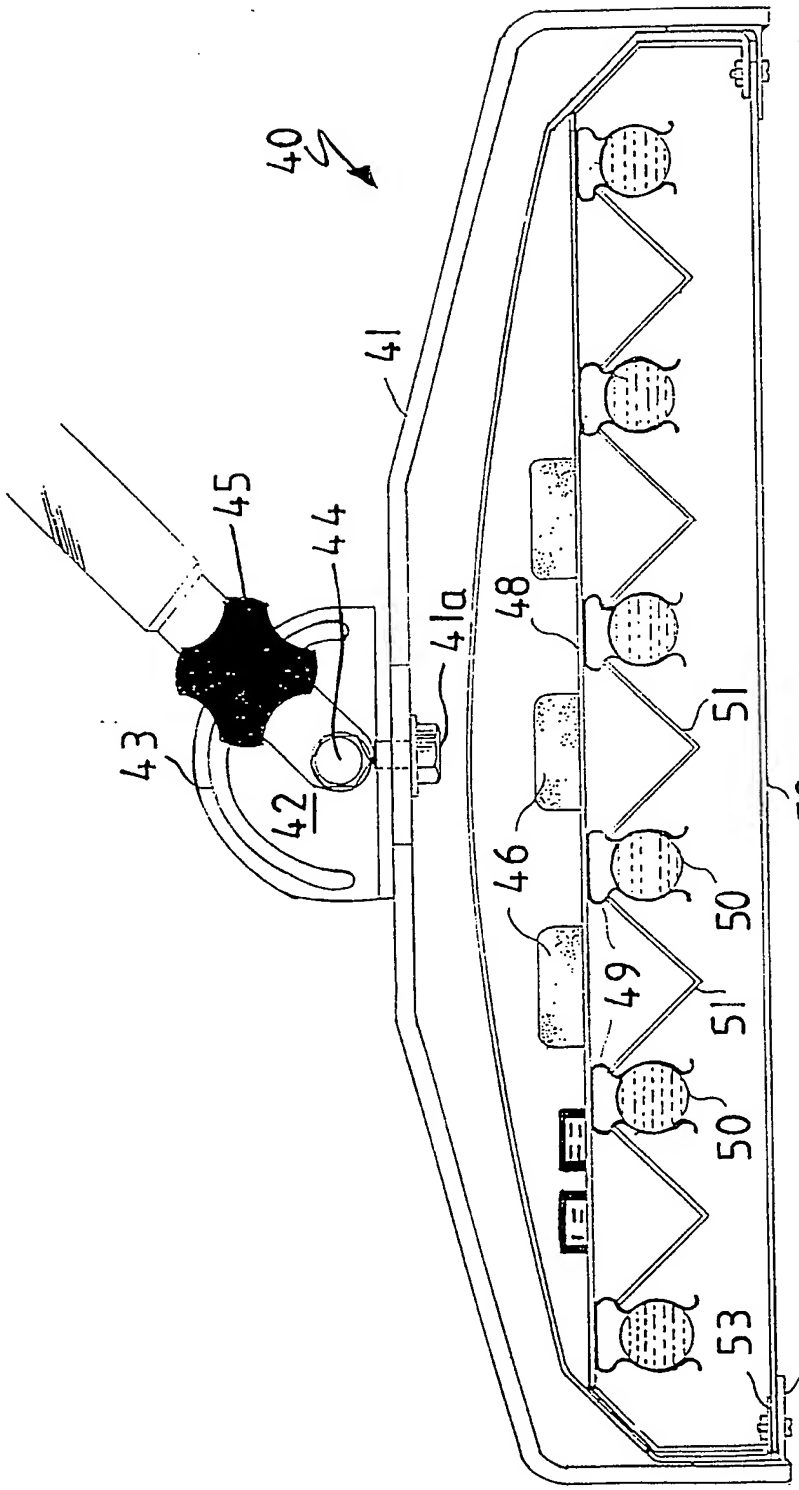


FIG 6.

Separation System

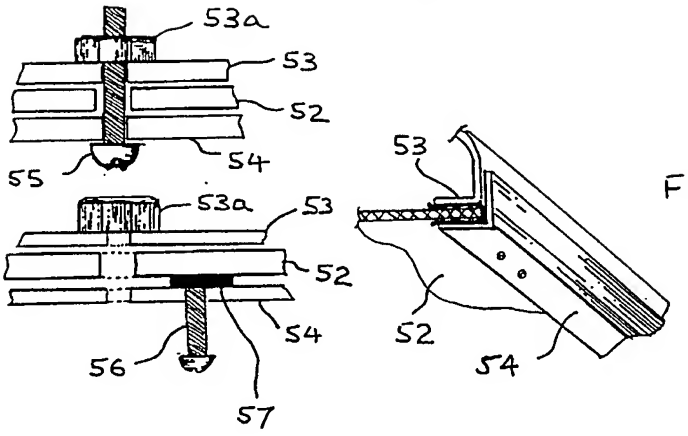
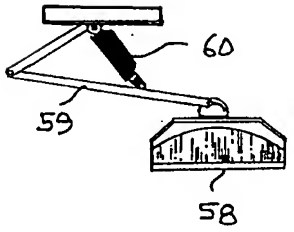


FIG 7.

Sample of Variations



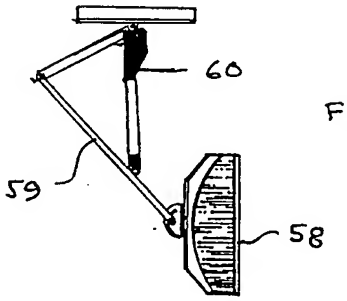


FIG 8.

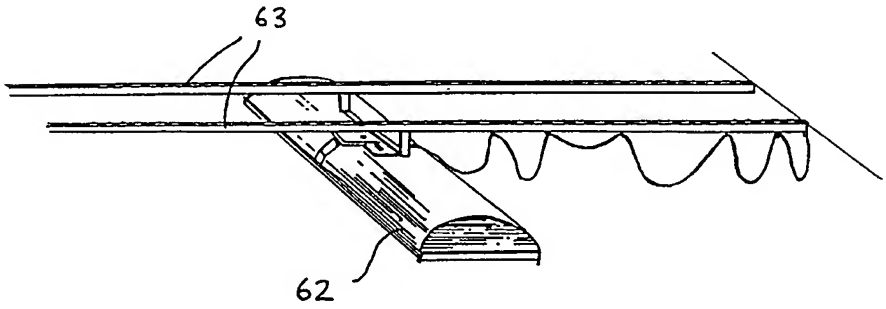


FIG 9.

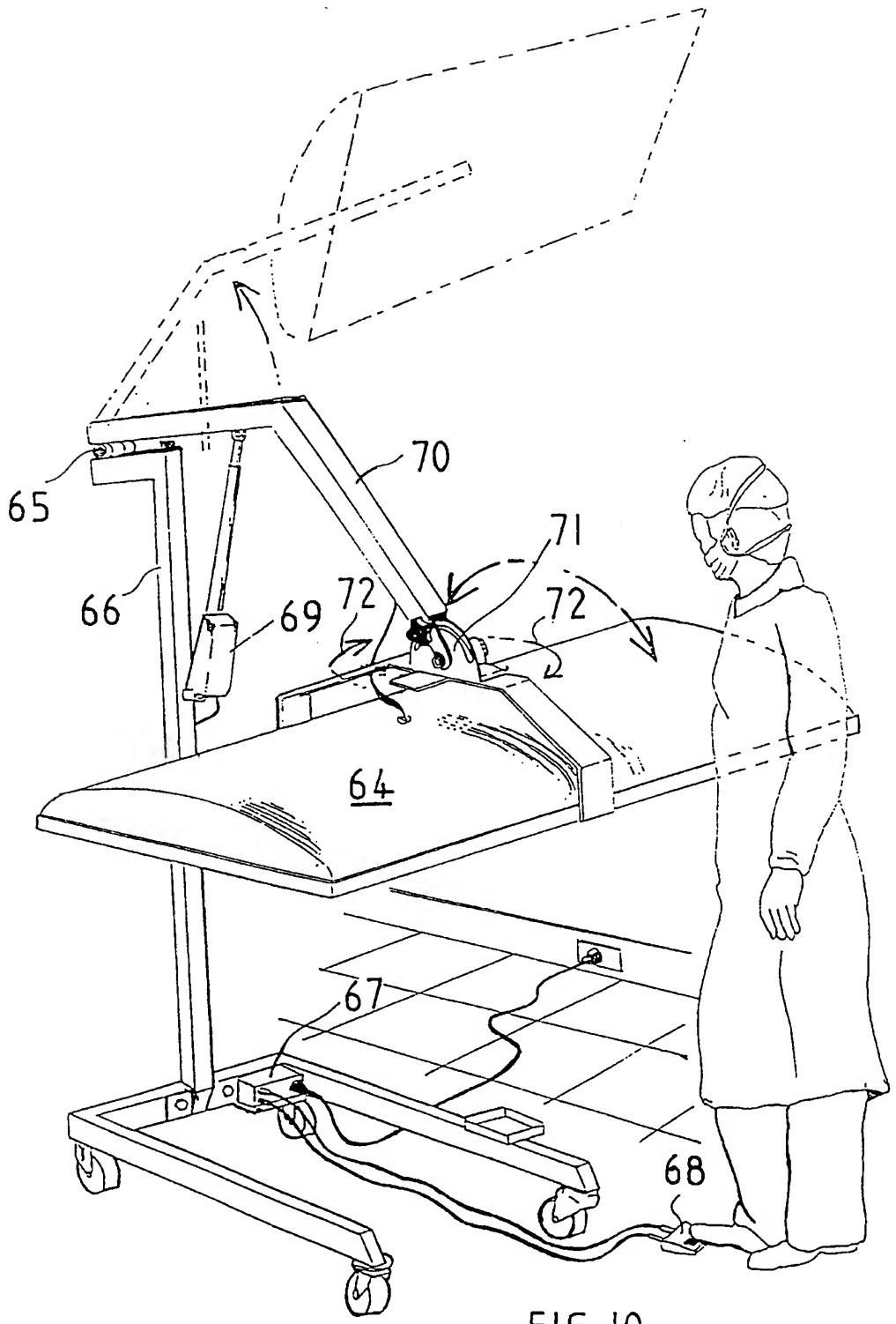


FIG 10.

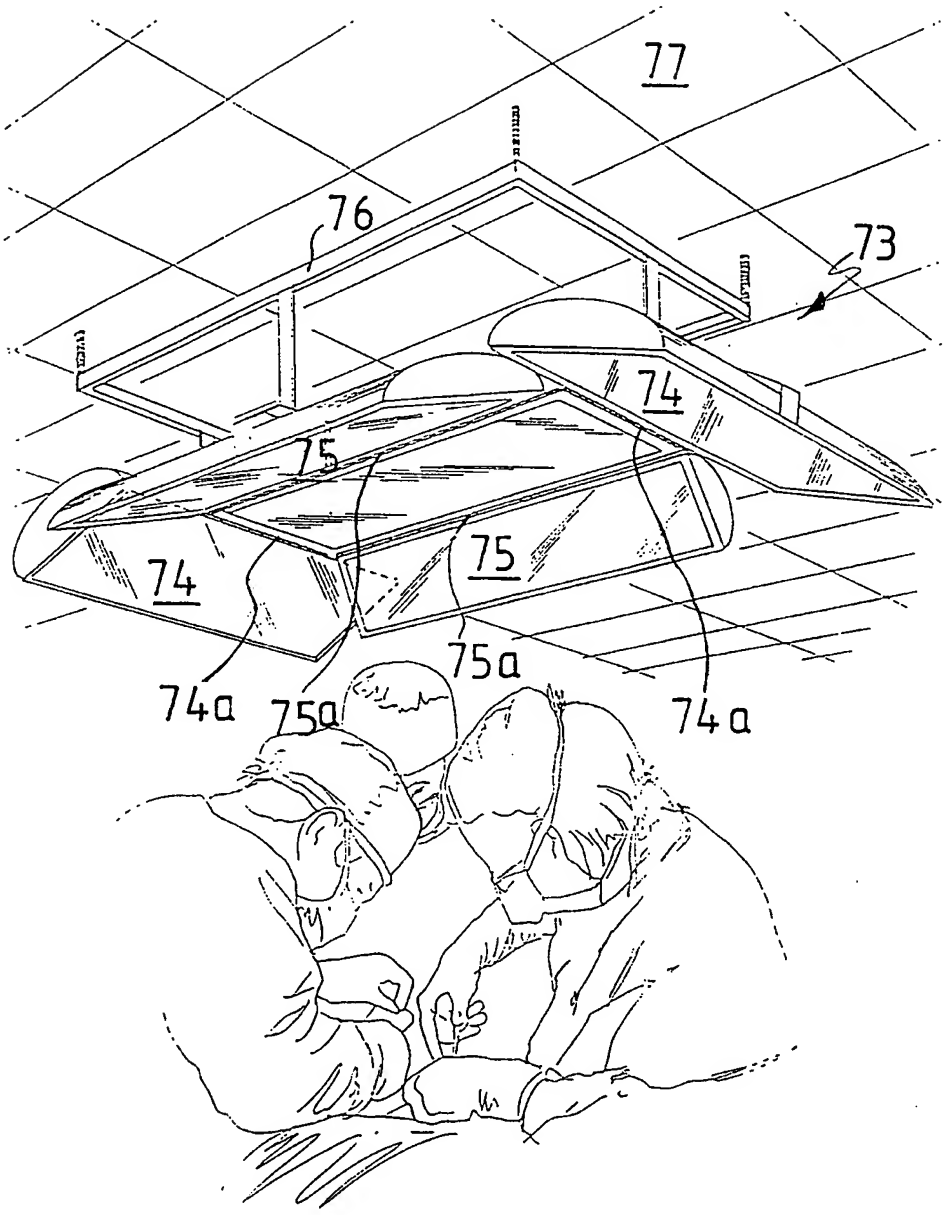


FIG. 11

Theatre Light

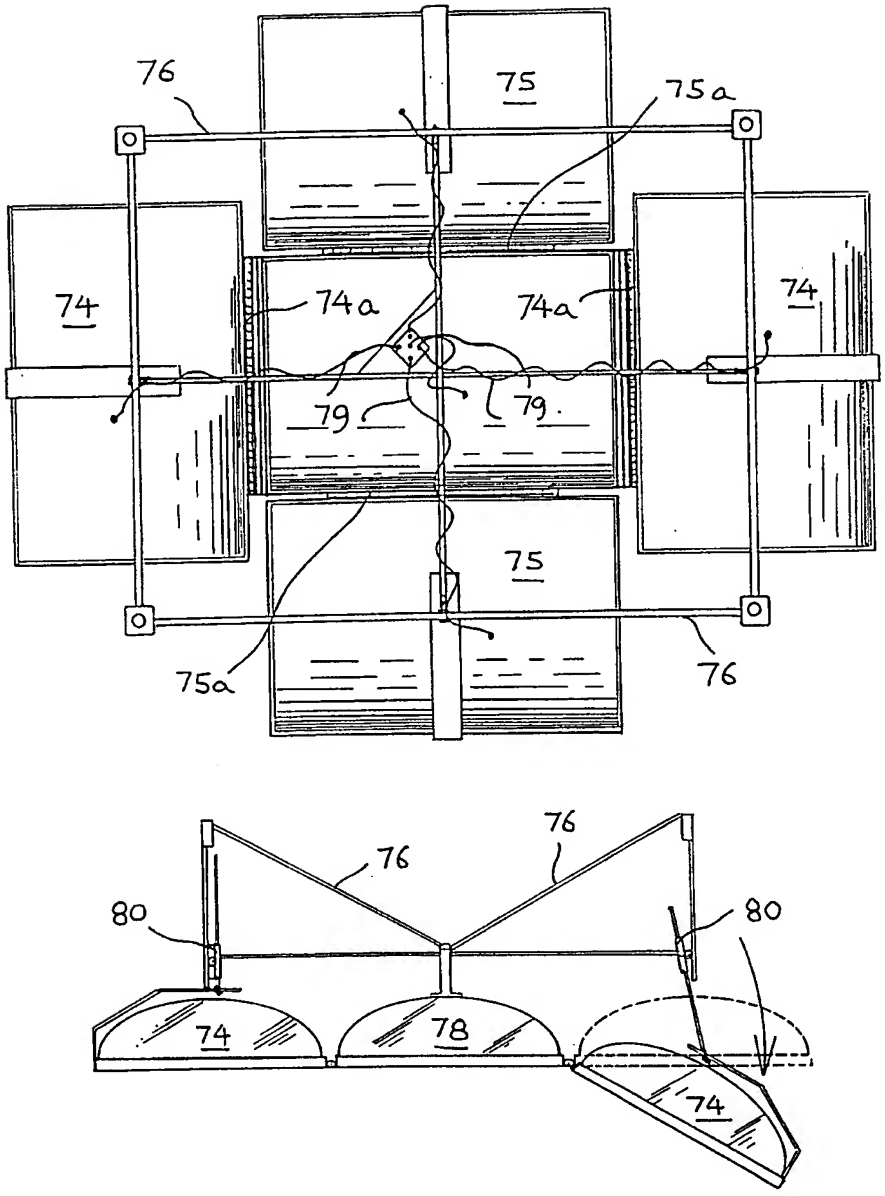


FIG. 12.

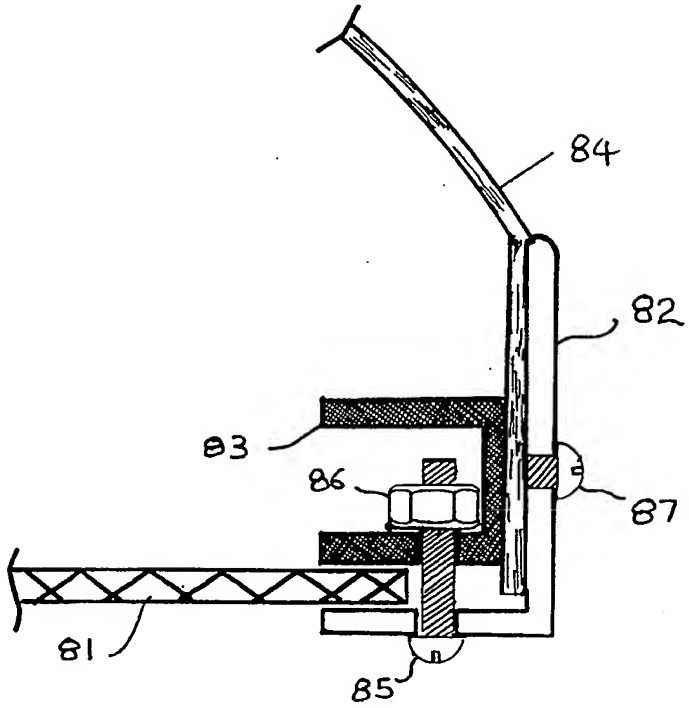


FIG. 13a.

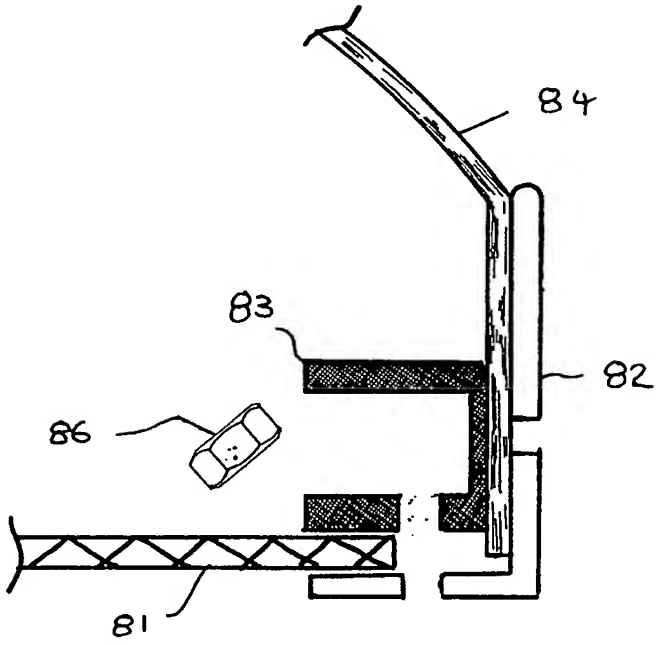


FIG 13b.

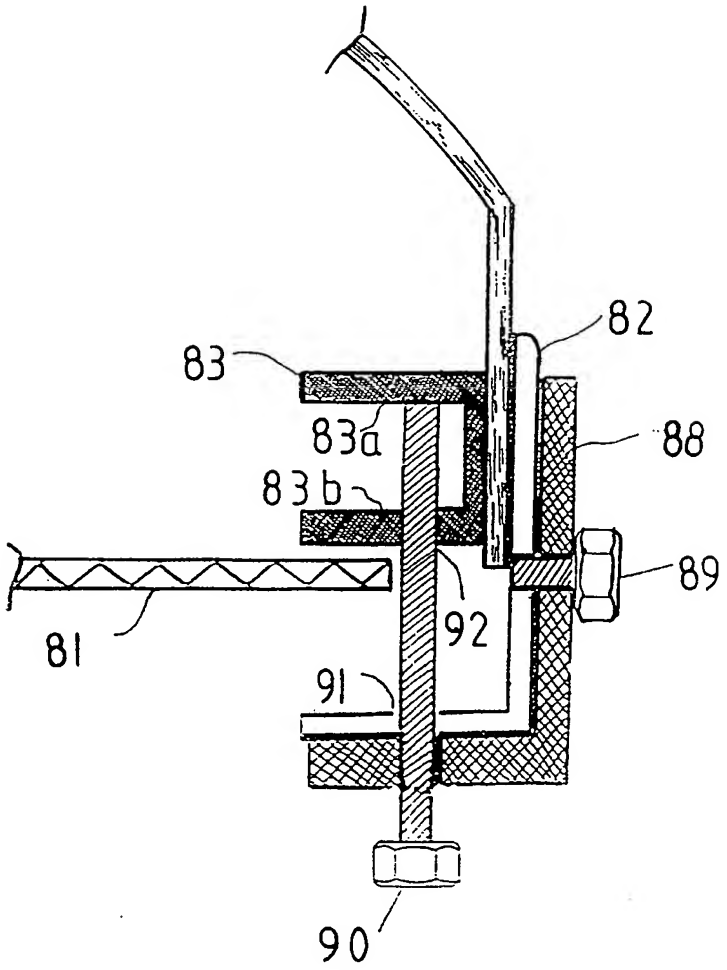


FIG 13c

INTERNATIONAL SEARCH REPORT

International Application No.
PCT/AU 97/00622

A. CLASSIFICATION OF SUBJECT MATTER

Int Cl[6]: IPC: F21M 1/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC: F21 M

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
AU:IPC as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
DERWENT: KEYWORDS
JAPIO : KEYWORDS

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5375049 A (WITT) 20 December 1994 See figure 1, column 3 line 62 - column 4 line 3	
A	US 5128848 A (ENDERS) 7 July 1992. See figure 1, column 3 lines 54-59	
A	US 4519021 (ORAM) 21 May 1985 See column 4 lines 38-62	

[X] Further documents are listed in the continuation of Box C

[X] See patent family annex

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
4 November 1997	28 NOV 1997
Name and mailing address of the ISA/AU AUSTRALIAN INDUSTRIAL PROPERTY ORGANISATION PO BOX 200 WODEN ACT 2606 AUSTRALIA Facsimile No.: (02) 6285 3929	Authorized officer **F.C.PEARSON** Telephone No.: (02) 6283 2195

INTERNATIONAL SEARCH REPORT

International Application No.
PCT/AU 97/00622

C (Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	DE 3408891 A (TRILUX LENZE) 12 September 1985 See figure 1 and 3	
A	DE 334142 A (FALLSCHUSSEL) 23 May 1985 See figure 1	
A	DT 2831857 A (ORIGINAL HANAU HERA)14 February 1980 See figure 1	
A	DT 2532946 A (ORIGINAL HANAU QUAR) 27 January 1977 See figure 1	
A	DT 2519426 (YAMADA IRYO SHOEMEI) 12 August 1976 See figures 5 and 6	

INTERNATIONAL SEARCH REPORT
Information on patent family members

International Application No.
PCT/AU 97/00622

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report		Patent Family Member					
US	5375049	DE	59205018	EP	548589		
US	5128848	AT	138460	DE	59010332	EP	391287
		ES	2087095	JP	3032662		
US	4519021	DE	3368752	DE	3377382	EP	93017
		EP	120549	JP	59000801	US	4591953
DE	3408891	AT	574/85				
DE	2831857	FR	2431656				
DE	2519426	JP	51064776	US	4025777		

END OF ANNEX